# Land Mobile Radio (LMR) Upgrades: Narrowbanding and Beyond

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# Executive Summary

## Part I: Utility Private Land Mobile Radio (PLMR) and Background

Federal Communications Commission (FCC) deadlines requiring the “refarming”, or “narrowbanding” of PLMR systems operating in spectrum bands below 512 MHz from current 25 KHz channels to 12.5 KHz channels are approaching quickly. In light of the mandate, UTC is publishing this updated report to provide an up-to-date perspective for analyzing and upgrading PLMR systems that will require upgrading for utilities to maintain Federal Communications Commission (FCC)-issued spectrum licenses.

In its ruling in 2004, the FCC mandated that:

- **As of January 1, 2011,** applications for PLMR frequencies between 150 MHz and 512 MHz must meet the spectrum efficiency standard of one channel per 12.5 KHz of bandwidth (voice) or 4800 bps per 6.25 KHz (data). Applications for 25 KHz operations that do not meet this standard will no longer be accepted; nor may manufacturers sell or import 25 KHz-only equipment after this date.

- **As of January 1, 2013,** all licensees are required to migrate to 12.5 KHz operations, or to a technology that achieves the equivalent of one channel per 12.5 KHz bandwidth for voice or 4800 bps per 6.25 KHz for data.

UTC believes there is little chance that the FCC will grant any waiver or extension of the 2011 or 2013 deadline; the FCC’s position is that licensees have had many years to prepare for transition to narrowbanding. ***Non-compliant spectrum licenses will automatically cancel after the 2013 deadline, and continued usage of expired licenses will be illegal and subject to fines***.

## Part II: PLMR System Upgrade Analysis

Part II of this report presents a step-by-step methodology for evaluation and selection of an LMR system upgrade. UTC recommends that utilities upgrading their systems take the opportunity to conduct a review of business requirements and related current and future needs of the utility before adopting a combined spectrum and technology solution. A thorough review would include five basic steps, described in significant detail in this report:

1. Collect PLMR System Information and Utility Business Requirements

2. Review and Analyze Spectrum Options and Frequency Congestion

3. Analyze Industry Wireless System Trends and Practices

4. Model and Compare Vendor Equipment Solutions and Costs

5. Bring Together an Analysis of Options

The coordinated review of organizational business requirements from all “clients” or “users” of the system sets the groundwork of parameters for system selection. Management must rank the business requirements to develop a feature set that will result in a radio system that is worthy of the investment of time and dollars. Both the current and future needs (business requirements) of the field force (and other “user groups’”) and their voice and data transmission requirements should be considered. This should include an overall review of voice and data geographic coverage needs and reliability requirements under harsh conditions. Spectrum issues must also be reconsidered, and any current and future spectrum that might be available for use should be tested for congestion and interference through a frequency coordinator (such as UTC Spectrum Services).

In line with industry trends, it is highly recommended that utilities overhauling systems take the time to evaluate the possibility, and suitability, of replacing conventional systems with trunked systems. Likewise, a cost-benefit analysis of replacing analog systems with digital, and perhaps IP-based systems, is warranted given the significant expenditure involved, and the long system life expected of LMR systems. Utility telecommunications departments must be aware of the increasing complexity and integration of utility communications systems stemming from “Smart Grid” and Advanced Metering Infrastructure (AMI) initiatives; it is advisable that new PLMR implementations take into consideration how radio infrastructures integrate with the broader, evolving vision of the overall utility communications infrastructure.

Lastly, vendor equipment must be selected to correspond with spectrum availability. Such an analysis involves review of system capabilities and how each vendor platform performs on the key business requirements -- both voice and data -- and at what approximate cost. This report outlines a summary of spectrum options and discusses frequency congestion and licensing requirements. An awareness of these critical system environment parameters, combined with the business requirements, will allow agencies to narrow the selection of equipment vendors and begin the process of developing proposal requests.

Land mobile systems range in complexity from simple single base station and mobile installations to wide area, multi-channels systems that use internet protocol (IP) to integrate with corporate data networks; the analysis includes a

detailed review of land mobile system vendors, and a high-level summary of communication technologies.

In addition, the report includes system cost modeling and a cost case study using a large utility example; the cost example presents cost ranges for upgrade of radios and major system components using cost estimates provided by nearly all major mobile radio equipment vendors in May, 2008.[1]

Depending on the combined spectrum/vendor, and the selected system configuration – whether, digital or analog, trunked or conventional – LMR upgrade can cost between $4.7 million and $23.5 million based on the UTC WUM model estimates. Using the same model, costs associated with replacing only the radios, and no changes to base station equipment, range between $2.9 million and $4.7 million, depending on the vendor equipment pricing.

We caution that each system is as unique as the individual relationships agencies have with their vendors. Final costs of such system involve considerable negotiations, so our “ball park” estimates for various system components should be verified with vendors and system designers.

Of course, system cost is not the only variable involved in choosing an appropriate LMR system. This report concludes by presenting a framework UTC has developed -- a “Business Requirements Matrix” evaluation -- which recommends a final system evaluation based on analysis of the various vendor/spectrum combinations along the range of utility voice and data requirements developed in step one.

## Conclusion

UTC understands the challenges that the FCC Narrowbanding mandate places on agencies with limited funds for such large system upgrades. Often, the systems that must be replaced are functioning properly, and have been doing so for 20 years or longer; in many cases, utilities remain pleased with the system performance. Nonetheless, as we stress repeatedly in this document, ***there is no circumventing the FCC narrowband deadline, and users of sub-512 MHz systems will be punished for non-compliance***. With less than five years to complete the necessary changes, additional pressure for financing may cause

[1] Using UTC proprietary Wireless Upgrade Model (WUM) based on vendor responses to equipment cost questionnaires distributed initially by UTC in May, 2008. Vendor data in this report is presented as a range without identifying the specific costs associated with specific equipment makers, as requested by the vendors. Final system costs will depend upon utility negotiations with vendors, and discounting arrangements that vendors are willing to offer based on the specific case.

utilities to accept solutions that are not in their long term best interest unless a thorough upgrade analysis process is applied. We hope this report will guide agencies through the necessary analysis that will lead to a wise decision.


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# Land Mobile Radio (LMR) Upgrades: Narrowbanding and Beyond

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